



Trickey, A. J. W., Stone, J., Semchuk, N., Saliuk, T., Sazonova, Y., Varetska, O., Lim, A. G., Walker, J. G., & Vickerman, P. T. (2020). Is contact between men who have sex with men and non-governmental organisations providing harm reduction associated with improved HIV outcomes? *HIV Medicine*. <https://doi.org/10.1111/hiv.13010>

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ORIGINAL RESEARCH

Is contact between men who have sex with men and non-governmental organizations providing harm reduction associated with improved HIV outcomes?

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Objectives

There is a high prevalence of HIV (5.2% in 2018) among men who have sex with men (MSM) in Ukraine. HIV testing, condom provision and facilitated linkage to HIV treatment have been funded by various bodies through non-governmental organizations (NGOs). We investigated whether contact with these NGOs was associated with improved prevention and treatment outcomes among MSM in Ukraine.

Methods

Data were taken from four rounds of integrated bio-behavioural surveys among MSM in Ukraine (2011, $N = 5950$; 2013, $N = 8101$; 2015, $N = 4550$; 2018, $N = 5971$) including HIV testing combined with questionnaire responses. Data were analysed using mixed-effect regression models, which estimated associations between being an NGO client and behavioural, HIV testing and HIV treatment outcomes, adjusted for demographic factors.

Results

Those MSM who were NGO clients were more likely than non-clients to have been HIV tested in the last year [adjusted odds ratio (aOR) = 7.01, 95% confidence interval (CI): 6.45–7.62] or ever (aOR = 11.00, 95% CI: 9.77–12.38), to have used a condom for the last anal sex act (aOR = 1.32, 95% CI: 1.21–1.43), and to have recently either bought or received condoms (aOR = 21.27, 95% CI: 18.01–25.12). HIV-positive MSM were more likely to have contact with NGOs (aOR = 1.61, 95% CI: 1.39–1.86). Among the HIV-positive MSM, those who were NGO clients were more likely to be registered at an AIDS centre (aOR = 2.24, 95% CI: 1.61–3.11) and to be on antiretroviral treatment (aOR = 2.20, 95% CI: 1.51–3.20).

Conclusions

In Ukraine, being in contact with MSM-targeted NGOs is associated with better outcomes for HIV prevention, testing and treatment, suggesting that NGO harm reduction projects for MSM have had a beneficial impact on reducing HIV transmission and morbidity.

Keywords: harm reduction, MSM, NGO, prevention, Ukraine

Accepted 9 October 2020

Introduction

Globally, there is consistent evidence that men who have sex with men (MSM) are at substantial risk of HIV

infection due to a high prevalence of HIV and a heightened probability of transmission through unprotected anal intercourse [1]. In eastern Europe and Central Asia, the region reporting the fastest-growing HIV epidemic in the world [2], HIV prevalence among MSM has been estimated at 6.6%, with over a fifth of all incident cases in the region occurring among MSM [1,3]. Ukraine is the second largest country in this region and has the second largest HIV burden [4], with an estimated 240 000 people living with HIV (PLWH) and an estimated 12 000 new HIV infections occurring annually [5]. HIV prevalence is

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estimated at 8.5% among the 181 000 MSM in Ukraine, suggesting that MSM account for c. 6.4% of PLWH in Ukraine [6].

Both globally and in Ukraine, MSM require interventions specifically targeted for the prevention and treatment of HIV, particularly condom distribution and antiretroviral therapy (ART) for HIV, to control their high HIV prevalence and incidence. Pre-exposure prophylaxis (PrEP) is also effective at preventing HIV transmission [7] but is not yet readily available in Ukraine [5]. While condom use can partially reduce the risk of HIV transmission [8], ART can effectively halt HIV transmission by reducing viral loads to undetectable levels [9]. Life expectancies for PLWH who are taking long-term ART are approaching those of the HIV-negative general population in some countries [10], while morbidity for those taking ART has drastically reduced [11]. For HIV-positive MSM to initiate ART requires them to be diagnosed and linked to care, requiring high testing coverage.

In Ukraine, most funding for HIV treatment and prevention has come from funding organizations such as the Global Fund to Fight AIDS, Tuberculosis and Malaria, with most funds going to non-governmental organizations (NGOs), e.g. the Alliance for Public Health (APH) and 100% Life [12]. The purpose of these NGOs is to reduce the epidemics of HIV and other infectious diseases among Ukraine's most vulnerable populations, including MSM, and their activities include condom distribution, HIV testing and counselling, and linkage to ART, which is provided by government-run AIDS centres. Recently, expectations that governments of middle-income country settings can and should fund their own interventions for HIV, hepatitis C virus and tuberculosis has led to global funders reducing their provision of funds to these settings, including Ukraine, where the latest Global Fund grant supports the transition of prevention services to the Ukrainian government [13] – from November 2019, core prevention activities, including testing and condom provision, have been supported by the government. These reductions, paired with a recent economic crisis and war with Russia, could lead to reductions in services provided to MSM and other key populations [14]. It is therefore important to show whether current services for MSM are having an impact and should therefore have continued support.

The APH has undertaken multiple rounds of nationwide cross-sectional integrated bio-behavioural surveys (IBBSs) among MSM to estimate and assess changes in risk behaviours and the coverage of prevention, testing and treatment interventions among MSM, and to monitor the dynamics of the HIV epidemic. We aimed to use data from these surveys, undertaken between 2011 and 2018,

to examine whether being a client of an MSM-targeted NGO in Ukraine is associated with improved HIV prevention, testing and treatment outcomes and reduced sexual-risk behaviours.

Methods

IBBS data

We used data from four nationwide IBBSs for MSM in Ukraine covering the years 2011, 2013, 2015 and 2018, which recruited MSM using respondent-driven sampling (RDS), with full details of the sampling methodology given in the survey reports [15–18]. Eligible participants reported at least one sexual (oral, anal) contact with another man in the past 6 months, were aged ≥ 14 years, and resided in a participating city. They needed to give consent to being surveyed, provide a dried blood spot sample, and agree to HIV testing. A person could participate in multiple rounds of the survey; however, there was no linkage ID between surveys so longitudinal outcomes of participants could not be assessed. The surveys included 28 cities, encompassing all of Ukraine's regions. The surveys were carried out in different venue types, mostly rented office blocks, AIDS centres and, in some cases, the offices of NGOs.

Participants were asked about demographic characteristics, sexual behaviours, harm reduction intervention contact and outcomes, recent contact and duration of contact with NGOs, HIV testing history, self-reported HIV diagnosis status, HIV treatment uptake and knowledge of HIV transmission. The questions included in each survey were similar across rounds but there were some minor differences, and, in some years, particular questions were added or excluded. Our analyses mostly focus on questions that are comparable across all rounds. In the 2018 survey, questions about PrEP were added. The question 'Are you a client of any non-governmental organization (have a card or an individual code) that provides prevention services for men who have sex with men?' was used to ascertain whether someone was a client of an NGO.

HIV testing using rapid tests (dried blood spot) was performed in each survey to determine a respondent's HIV status. Hepatitis C virus and syphilis were also tested for, but these results are not considered in this study, which focused on HIV.

Analyses

All analyses were carried out in Stata 15.1. RDS weights were not used in the main analysis due to a lack of consensus around their validity in regression models [19],

particularly when RDS surveys across multiple sites are combined. However, we present RDS-weighted characteristics for comparison in sensitivity analyses.

Trends over time

Trend tests for variables across multiple survey years were performed using logistic or linear regression, depending on whether the outcome variable was binary or continuous, with cluster-robust standard errors being used for clustering by city. Time was included as a continuous variable.

Comparing MSM by NGO client status

Tests for differences in behaviours and preventive outcomes by current NGO client status (combined over all the years) were assessed by either χ^2 or *t*-tests, depending on whether the variable was binary or continuous.

Characteristics associated with being an NGO client

We tested for general non-intervention-related characteristics associated with being an NGO client (*vs.* not), using mixed-effect logistic regression with city and year as the crossed random-effects. In unadjusted and adjusted analyses, we investigated whether testing HIV-positive (*vs.* negative), age (years), having ever been imprisoned (*vs.* not), education level (categorical), being transgender, having provided sex for money in the last 6 months, having had sex with a woman in the last 6 months, and total number of anal sex partners in the last month were associated with being an NGO client. Data from 2011 were excluded as the question on being transgender was not available for that year.

Associations between being an NGO client and intervention-related outcomes

To assess for associations between NGO client status and various intervention-related outcomes around HIV transmission, we used mixed-effect logistic regression models with city and year as the crossed random effects. Unadjusted and adjusted associations of the outcomes with NGO client status, while adjusting for age, having ever been imprisoned, higher education level, group sex in the last 6 months, chemsex in the last 6 months, being transgender, having had sex with a woman in the last 6 months, and total number of anal sex contacts in the last month were assessed. Model fit was assessed by observing the pseudo- R^2 values.

Cascade of care

Data from the earliest and most recent surveys (2011 and 2018) were used to create HIV cascades of care to compare the outcomes over the two time points. The cascades included the number of MSM testing HIV-positive, the number self-reporting being HIV-positive, the number reporting being registered at an AIDS centre (a requirement for receipt of ART in Ukraine), and the number reporting that they receive ART. Differences in the HIV cascade of care stages by whether MSM were NGO clients or not were assessed using χ^2 tests.

Ethical approval

All procedures involving human participants were performed in accordance with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The surveys were examined by the Committee of Medical Ethics from the Institute of Epidemiology and Infectious Diseases of the Ukrainian Academy of Medical Sciences. Informed consent was obtained from all study participants.

Results

Trends over time and overall values across the survey years for various demographic, behavioural and HIV-related variables are shown in Table 1. Table S1 shows the same breakdown of results by year using RDS weights, giving similar results. In all, 5950 MSM were sampled in 2011, 8101 in 2013, 4550 in 2015, and 5971 in 2018. Overall, around 31% of MSM surveyed were NGO clients. The mean age of those surveyed was 29 years. The percentage of clients who self-reported using a condom during their last anal sex with a male partner was 73.3% (83.9% for the last casual partner), whilst 50.5% self-reported always using condoms for anal sex over the previous 30 days. Overall, 3.6% had been imprisoned at some time, 33.3% had higher education, and 23.8% had had sex with a woman in the last 12 months. The mean total number of anal sex partners reported in the last 30 days was 2.6. Around 3.4% reported that they paid another man for anal sex within the last 30 days, whilst 4.9% engaged in chemsex (taking drugs before sex), and 1.9% had injected drugs at some time.

Comparing MSM by NGO client status

There were differences in the characteristics and behaviours of NGO and non-NGO clients for many of the

Table 1 Behaviours and preventive outcomes among men who have sex with men across each survey year, with a test for trends across years*

Variable	2011 (N = 5950)	2013 (N = 8101)	2015 (N = 4550)	2018 (N = 5971)	Total (N = 24572)	Test for trend over time [coefficient (95% CI)]*	P-value
NGO client	25.8%	30.6%	41.6%	28.3%	30.9 %	0.07 (−0.07–0.22)	0.323
Mean NGO client duration (months)	17.8	25.1	25.2	30.2	24.8	3.27 (1.84–5.30)	< 0.001
Mean age (years)	27.6	28.4	29.4	28.9	28.5	0.47 (−0.02–0.96)	0.057
Age of first sex (oral or anal) with man	17.9	17.8	18	18	17.9	0.04 (−0.16–0.25)	0.663
Bisexual	31.0%	26.6%	32.2%	33.1%	30.3%	0.06 (−0.02–0.14)	0.159
Transgender	NA	3.1%	2.5%	2.4%	2.7%	−0.13 (−0.41–0.15)	0.359
Ever imprisoned	3.5%	3.5%	4.2%	3.2%	3.6%	−0.02 (−0.18–0.16)	0.886
Higher education	34.0%	33.0%	34.9%	31.8%	33.3%	−0.02 (−0.10–0.05)	0.554
Mean number of total anal sex partners in last 30 days	2.7	2.6	NA	2.4	2.6	0.12 (−0.29–0.05)	0.152
Mean number of casual and permanent anal sex partners in last 30 days	2.5	2.4	2.4	2.2	2.4	−0.10 (−0.25–0.06)	0.215
Mean number of permanent anal sex partners in last 30 days	0.8	0.8	0.8	0.8	0.8	0.02 (−0.06–0.02)	0.349
Mean number of casual anal sex partners in last 30 days	1.7	1.6	1.6	1.4	1.6	−0.07 (−0.22–0.07)	0.319
Mean number of partners they paid for anal sex in last 30 days	0.06	0.07	0.06	0.04	0.06	−0.01 (−0.02–0.00)	0.22
Mean number of partners who paid them for anal sex in last 30 days	0.2	0.2	NA	0.1	0.2	−0.02 (−0.06–0.01)	0.212
Percentage with no anal sex partners in the last 30 days	9.6%	10.1%	15.0%	19.5%	13.2%	0.31 (0.15–0.47)	< 0.001
Condom for last anal sex with male partner	70.1%	73.4%	72.1%	77.6%	73.3%	0.11 (−0.03–0.26)	0.13
Condom for last anal sex with permanent partner	62.1%	63.4%	66.2%	70.6%	65.2%	0.13 (−0.03–0.29)	0.119
Condom for last anal sex with casual partner	79.2%	83.2%	87.8%	87.9%	83.9%	0.24 (−0.02–0.49)	0.067
Condom for last anal sex with commercial partner (they paid)	86.4%	93.2%	91.0%	85.8%	90.2%	−0.08 (−0.46–0.30)	0.69
Condom for last anal sex with commercial partner (they were paid)	79.0%	77.4%	80.7%	74.7%	78.0%	−0.05 (−0.32–0.23)	0.744
Always used condoms for anal sex in last 30 days	47.9%	52.4%	49.6%	51.1%	50.5%	0.03 (−0.12–0.17)	0.729
Ever provided sex for money	NA	16.0%	16.7%	16.6%	16.3%	0.02 (−0.15–0.19)	0.781
Provided sex for money in the last 6 months	10.0%	5.7%	15.1%	7.9%	9.0%	0.03 (−0.08–0.15)	0.568
% bought anal sex in the last 30 days	2.7%	4.6%	3.2%	2.5%	3.4%	−0.08 (−0.23–0.07)	0.314
Group sex in the last 6 months	NA	21.6%	23.1%	17.2%	20.5%	−0.13 (−0.23 to −0.02)	0.016
Percentage who had sex with a woman in last 6 months	25.8%	23.4%	23.7%	22.3%	23.8%	−0.05 (−0.14–0.03)	0.194
Used condom for last sex with female	66.7%	66.2%	62.0%	72.5%	69.0%	0.06 (−0.05–0.17)	0.261
Chemsex in last 30 days	NA	6.7%	0.9%	5.4%	4.9%	−0.19 (−0.49–0.11)	0.212
Ever injected drugs	2.5%	1.8%	1.6%	1.9%	1.9%	−0.09 (−0.36–0.18)	0.500
Suffered violence or abuse from organized movements	NA	NA	7.4%	7.9%	7.7%	0.07 (−0.27–0.41)	0.696
Received free condoms in the last 12 months	60.1%	51.0%	52.7%	44.2%	51.9%	−0.18 (−0.35 to −0.02)	0.028
Bought condoms last month	31.4%	40.3%	27.7%	35.3%	34.6%	−0.01 (−0.12–0.11)	0.924
Received free condoms in the last 12 months or bought condoms last month	79.5%	80.0%	74.1%	71.6%	76.7%	−0.17 (−0.31 to −0.02)	0.025
Ever received an HIV test	60.5%	64.3%	77.6%	65.4%	66.1%	0.12 (0.02–0.22)	0.023
HIV tested last year	41.7%	41.4%	51.4%	43.9%	43.9%	0.06 (−0.04–0.16)	0.214
HIV tested by NGO last year	17.1%	21.2%	35.3%	27.1%	24.2%	0.23 (0.08–0.38)	0.002
Self-reporting HIV-positive	1.5%	1.4%	1.6%	2.5%	1.7%	0.20 (−0.05–0.45)	0.124
Registered at an AIDS centre (of N = 420 self-reporting HIV-positive)	75.0%	87.7%	90.3%	91.9%	87.1%	0.33 (0.03–0.64)	0.032
On antiretroviral therapy (of N = 420 self-reporting HIV-positive)	38.9%	63.4%	36.9%	92.7%	56.4%	0.69 (0.53–0.86)	<0.001
HIV-positive	6.4%	4.3%	7.8%	5.2%	5.7%	−0.00 (−0.12–0.12)	0.97
HIV-positive of N = 9606 aged < 25 years	4.5%	1.9%	4.3%	2.4%	3.1%	−0.14 (−0.32–0.04)	0.117
Registered in an AIDS centre (of N = 1393 HIV-positive)	18.8%	26.4%	18.1%	42.3%	25.8%	0.31 (0.03–0.60)	0.031
On antiretroviral therapy (of N = 1393 HIV-positive)	7.3%	17.1%	6.5%	39.1%	16.7%	0.62 (0.30–0.95)	<0.001

95% CI, 95% confidence interval; NGO, non-governmental organization; NA, not available; chemsex, taking drugs (typically stimulants) before sex (excluding alcohol).

*Trend test coefficient produced using logistic or linear regression modelling (depending on variable type) with survey year as an independent variable and clustering of standard errors by city.

variables assessed (Table 2). These included the mean number of anal sex partners in the last 30 days, the mean number of casual anal sex partners, the mean number of partners they paid for anal sex, the mean number of partners who paid them for anal sex, and the proportions reporting using a condom for their last anal sex act that they bought. NGO clients were more likely to have used a condom during their last anal sex act with a male partner

and for each type of partner (except when buying anal sex). NGO clients were also more likely to report always using condoms for anal sex in the previous 30 days and to have ever provided sex for money. MSM were asked about PrEP in the 2018 survey, with 896 (53.2%) NGO clients having heard of it *vs.* 1001 (23.5%) non-NGO clients ($P < 0.001$), whilst 33 (2.2%) of HIV-negative NGO clients reported being on PrEP in the previous year

Table 2 Behaviours and preventive outcomes among men who have sex with men across each survey year and combined across survey years, stratified by whether they are non-governmental organization (NGO) clients or not and tested for differences*

Variable	Non-NGO					NGO					Test for differences between the two total groups*
	2011 (N = 4391)	2013 (N = 5598)	2015 (N = 2646)	2018 (N = 4265)	Total (N = 16900)	2011 (N = 1530)	2013 (N = 2467)	2015 (N = 1888)	2018 (N = 1684)	Total (N = 7569)	
Mean age (years)	27.7	28.3	29.2	28.3	28.3	27.6	28.6	29.8	30.5	29.1	< 0.001
Age of first sex (oral or anal) with man	18.1	18	18.2	18.1	18.1	17.3	17.4	17.6	17.6	17.5	< 0.001
Bisexual	33.6%	29.0%	36.2%	36.0%	33.1%	23.7%	21.4%	26.6%	25.8%	24.1%	< 0.001
Transgender	NA	2.0%	2.0%	2.1%	2.4%	NA	3.5%	3.1%	3.0%	3.2%	0.002
Ever imprisoned	3.7%	3.5%	5.1%	3.4%	3.8%	3.1%	3.6%	2.9%	2.8%	3.1%	0.015
Higher education	33.4%	31.2%	32.1%	30.9%	31.8%	35.8%	37.5%	38.8%	34.1%	36.7%	< 0.001
Mean number of total anal sex partners in last 30 days	2.7	2.6	NA	2.4	2.6	2.9	2.6	NA	2.3	2.6	0.235
Mean number of casual and permanent anal sex partners in last 30 days	2.5	2.4	2.3	2.2	2.4	2.7	2.5	2.4	2.2	2.5	0.05
Mean number of permanent anal sex partners in last 30 days	0.8	0.8	0.7	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.003
Mean number of casual anal sex partners in last 30 days	1.6	1.5	1.6	1.5	1.5	1.8	1.6	1.6	1.4	1.6	0.309
Mean number of partners they paid for anal sex in last 30 days	0.05	0.07	0.07	0.05	0.06	0.07	0.06	0.04	0.02	0.05	0.132
Mean number of partners who paid them for anal sex in last 30 days	0.2	0.2	NA	0.1	0.2	0.2	0.2	NA	0.1	0.2	0.727
Percentage with no anal sex partners in the last 30 days	9.1%	10.3%	15.5%	19.0%	13.0%	10.7%	9.6%	14.1%	20.6%	13.4%	0.466
Condom for last anal sex with male partner	67.4%	70.5%	70.2%	77.3%	71.3%	77.4%	79.7%	74.7%	78.4%	77.7%	< 0.001
Condom for last anal sex with permanent partner	60.7%	60.9%	63.1%	71.2%	63.6%	65.8%	68.6%	69.6%	69.3%	68.5%	< 0.001
Condom for last anal sex with casual partner	75.5%	79.4%	84.0%	86.7%	80.6%	90.3%	92.6%	93.5%	91.3%	92.1%	< 0.001
Condom for last anal sex with commercial partner (they paid)	85.5%	92.4%	91.2%	87.0%	89.7%	89.5%	95.3%	90.7%	81.3%	91.3%	0.492
Condom for last anal sex with commercial partner (they were paid)	73.9%	76.2%	77.8%	74.7%	75.7%	89.2%	81.0%	84.8%	75.0%	83.0%	0.005
Always used condoms for anal sex in last 30 days	45.8%	49.3%	46.9%	51.1%	48.5%	53.9%	59.5%	53.3%	51.5%	55.0%	< 0.001
Ever provided sex for money	NA	15.6%	14.9%	16.0%	15.6%	NA	16.7%	19.1%	18.2%	17.8%	< 0.001
Provided sex for money in the last 6 months	9.4%	6.0%	13.3%	7.9%	8.5%	11.5%	5.1%	17.5%	7.8%	10.1%	< 0.001
Percentage who bought anal sex in the last 30 days	2.8%	4.7%	3.5%	2.7%	3.5%	2.5%	4.3%	2.9%	1.9%	3.0%	0.054
Group sex in the last 6 months	NA	21.0%	21.3%	16.2%	19.5%	NA	22.7%	25.7%	19.6%	22.8%	< 0.001
Percentage who had sex with a woman in last 6 months	27.9%	26.9%	27.6%	25.4%	26.9%	19.4%	15.5%	18.5%	14.5%	16.8%	< 0.001
Used condom for last sex with female	64.2%	65.8%	61.7%	72.3%	66.3%	76.2%	67.8%	62.6%	73.0%	69.4%	0.042
Chemsex in last 30 days	NA	7.6%	1.0%	5.7%	5.5%	NA	4.6%	0.9%	4.6%	3.4%	< 0.001
Ever injected drugs	2.9%	2.2%	1.7%	1.9%	2.2%	1.1%	0.7%	1.3%	2.1%	1.2%	< 0.001
Suffered violence or abuse from organized movements	NA	NA	6.9%	7.6%	7.3%	NA	NA	8.2%	8.7%	8.4%	0.047
Received free condoms in the last 12 months	46.9%	30.4%	21.3%	24.5%	31.8%	97.3%	97.2%	96.4%	94.1%	96.3%	< 0.001
Bought condoms last month	39.3%	53.1%	42.1%	44.9%	45.7%	8.7%	11.3%	7.5%	10.8%	9.7%	< 0.001
Received free condoms in the last 12 months or bought condoms last month	72.9%	72.0%	57.3%	62.1%	67.4%	98.2%	98.1%	97.5%	95.7%	97.4%	< 0.001
Ever received an HIV test	51.8%	53.5%	63.9%	54.0%	54.8%	85.7%	88.7%	96.8%	94.5%	91.4%	< 0.001
HIV tested last year	31.8%	29.3%	32.5%	30.7%	30.8%	70.6%	68.9%	78.0%	77.7%	73.5%	< 0.001
HIV tested by NGO last year	9.6%	9.2%	12.3%	10.3%	10.1%	38.7%	48.5%	67.5%	69.5%	55.9%	< 0.001
Self-reporting HIV-positive	1.0%	0.8%	1.1%	1.3%	1.0%	2.8%	2.6%	2.3%	5.4%	3.2%	< 0.001
Registered at an AIDS centre (of those self-reporting HIV-positive)	70.5%	84.1%	86.2%	87.7%	82.2%	90.5%	84.4%	90.9%	94.5%	90.5%	0.013

Table 2 (Continued)

Variable	Non-NGO					NGO					Test for differences between the two total groups*
	2011 (N = 4391)	2013 (N = 5598)	2015 (N = 2646)	2018 (N = 4265)	Total (N = 16900)	2011 (N = 1530)	2013 (N = 2467)	2015 (N = 1888)	2018 (N = 1684)	Total (N = 7569)	
On antiretroviral therapy (of those self-reporting HIV-positive)	18.2%	50.0%	34.5%	82.5%	50.0%	45.2%	54.7%	31.8%	86.8%	61.0%	0.026
HIV-positive	5.8%	3.3%	6.9%	3.8%	4.6%	8.2%	6.4%	8.9%	8.9%	7.9%	< 0.001
HIV -positive of those aged < 25 years	4.4%	1.5%	3.2%	1.5%	2.5%	4.9%	3.0%	6.3%	5.6%	4.7%	< 0.001
Registered at an AIDS centre (of those HIV-positive)	12.2%	20.2%	13.7%	29.8%	18.1%	30.4%	32.9%	23.2%	56.0%	35.4%	< 0.001
On antiretroviral therapy (of those HIV-positive)	3.20%	12.0%	5.5%	28.0%	10.9%	15.20%	22.20%	7.70%	51.30%	24.00%	< 0.001

Chemsex, taking drugs (typically stimulants) before sex (excluding alcohol).

* χ^2 test for binary variables, or a *t*-test for continuous variables, stratified by non-NGO vs. NGO client status across the combined survey year groups.

compared with 43 (1.1%) HIV-negative non-NGO clients ($P = 0.001$).

Non-intervention-related characteristics associated with being an NGO client

Table 3 shows the non-intervention-related characteristics associated with being an NGO client. In adjusted analyses, HIV-positive MSM were more likely to be NGO clients than were non-NGO clients. The older the MSM, the more likely they were to be NGO clients, while MSM with a higher education level were also more likely to be NGO

clients. Transgender MSM were more likely to be NGO clients, while MSM who reported sex with a woman in the last 6 months were less likely to be NGO clients. Having been imprisoned at some point, having provided sex for money in the last 6 months, and the total number of anal sex contacts in the last month were not associated with being an NGO client in adjusted analyses.

Associations between being an NGO client and intervention-related outcomes

Figure 1 and Tables S2 and S3 show the adjusted associations between being an NGO client and various HIV-related intervention outcomes. Being an NGO client was positively associated with all outcomes considered except for being registered at an AIDS centre and being on ART among those self-reporting as HIV-positive; however, being an NGO client was positively associated with these two outcomes among those testing HIV-positive. Having bought condoms in the previous month was negatively associated with being an NGO client [adjusted odds ratio (aOR) = 0.12, 95% confidence interval (CI): 0.11–0.13]. However, NGO clients were more likely to have received free condoms in the previous year (aOR = 80.78, 95% CI: 69.62–93.72), and were also more likely to have either bought condoms in the last month or received free condoms in the previous year (aOR = 21.27, 95% CI: 18.01–25.12), a composite measure. The other outcomes that were positively associated with being an NGO client were being HIV-tested in the last year (among those HIV-negative at the time of the survey), ever being HIV-tested, using a condom for the last anal intercourse (overall, with a permanent partner, or with a casual partner), being HIV-positive, being aware of their HIV-positive status among those testing HIV-positive, being registered at an AIDS centre among those testing HIV-positive, and being on ART among those testing HIV-positive.

Table 3 Unadjusted and adjusted odds ratios (with 95% confidence intervals) from mixed-effect logistic regression* of being a non-governmental organization (NGO) client for various demographic characteristics

Outcome variable: NGO client	Odds ratio (95% confidence interval)	
	Unadjusted	Adjusted (N = 18 277)
HIV-positive	1.67 (1.44–1.93)	1.61 (1.39–1.86)
Age (continuous, per 10-year increase)	1.13 (1.09–1.18)	1.07 (1.03–1.12)
Ever imprisoned	0.90 (0.74–1.08)	1.01 (0.83–1.23)
Transgender	1.28 (1.05–1.57)	1.35 (1.10–1.67)
Provided sex for money in last 6 months	0.95 (0.84–1.07)	1.04 (0.92–1.19)
Had sex with a woman in last 6 months	0.56 (0.51–0.61)	0.55 (0.50–0.60)
Total anal sex contacts last month	1.00 (0.99–1.01)	1.00 (0.99–1.01)
Education		
Incomplete secondary	1	1
Complete secondary	1.06 (0.80–1.40)	1.07 (0.81–1.43)
Vocational secondary	1.98 (1.52–2.57)	1.95 (1.49–2.55)
Incomplete higher	2.06 (1.58–2.69)	2.04 (1.55–2.68)
Higher	2.34 (1.80–3.04)	2.25 (1.71–2.95)
Scientific degree	2.60 (1.70–3.98)	2.59 (1.67–4.01)

*With year and city as the crossed random effects and excluding the 2011 data, as the question on being transgender was not included.

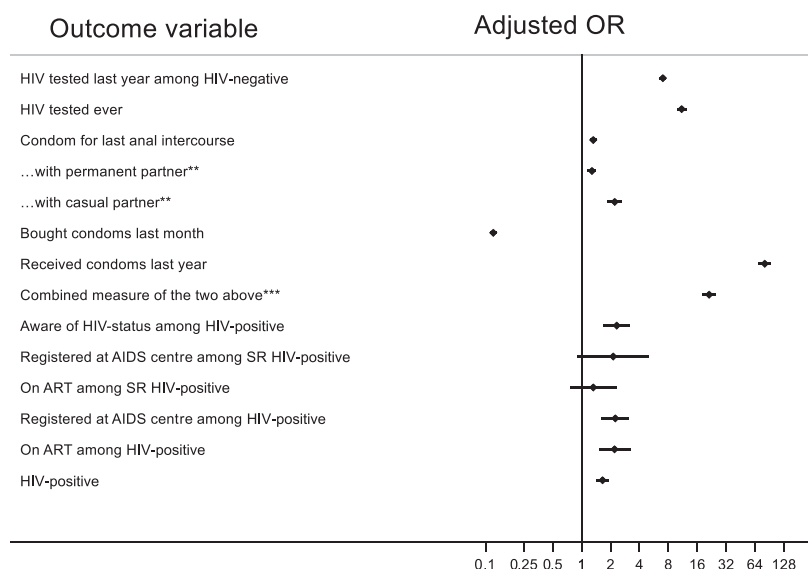


Fig. 1 Adjusted* odds ratios (with 95% confidence intervals) for various outcomes from being a non-governmental organization (NGO) client vs. not being a NGO client, using mixed-effect logistic regression. *, adjusted for age, ever imprisoned, higher education, total anal sex contacts in last month, having had sex with a woman in last 6 months, group sex in the last 6 months, chemsex in the last 30 days, being transgender, and having provided sex for money in the last 6 months, with city and year as crossed-effects; **, condom for last anal intercourse; ***, either bought condoms last month or received condoms last year. SR, self-reported; ART, antiretroviral therapy; 'among HIV-positive/negative' refers to those testing positive/negative.

Cascade of care

The HIV cascades of care among MSM in Ukraine for 2011 and 2018 split by NGO client status are shown in Fig. 2. In 2018, a higher proportion of HIV-positive NGO clients than non-NGO clients were aware of their HIV status, self-reported being registered at an AIDS centre, and were on ART (all $P < 0.001$). Better outcomes were also seen for NGO clients for each stage of the cascade of care

in 2011. Between 2011 and 2018, the outcomes improved for both NGO and non-NGO clients; however, the differences between the two groups also increased.

Discussion

Our analyses of data from four national IBBSs of MSM in Ukraine spanning 2011–2018 show that being a client of an NGO is associated with consistently better preventive,

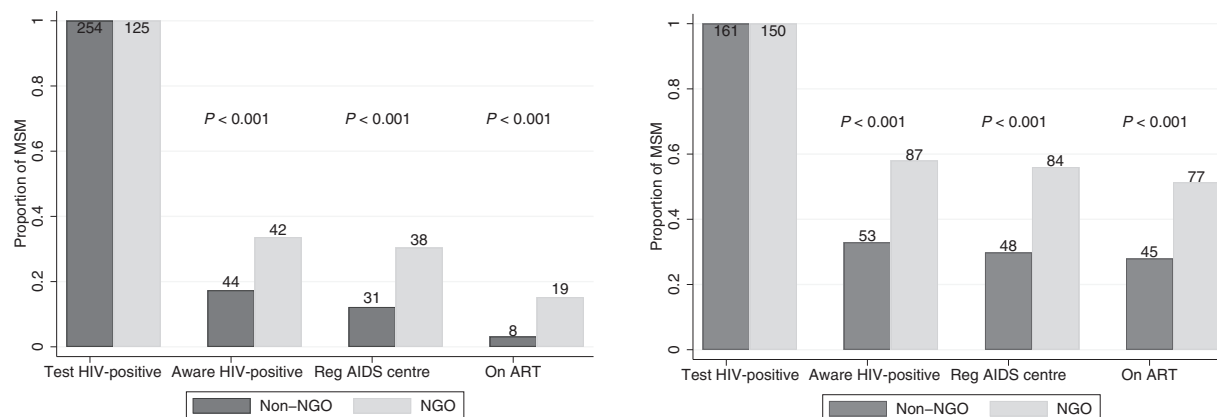


Fig. 2 HIV cascade of care among all HIV-positive men who have sex with men (MSM) for 2011 (left) and 2018 (right), stratified by whether they are non-governmental organization (NGO) clients or not, with tests for differences in proportions across groups. 'Reg', 'registered at'; ART, antiretroviral therapy.

HIV testing and HIV treatment outcomes. First, MSM who were clients of NGOs were more likely than those who were not clients to have received condoms (freely or bought) and to have used a condom for their last anal intercourse. Second, each step of the HIV cascade of care was better among clients of NGOs. They were more likely to have ever been tested for HIV and to have been tested in the previous year. If they were HIV-positive, they were more likely to be aware of their status, to be registered at an AIDS centre, and to self-report being on ART than their non-NGO client counterparts. Third, NGO clients were more likely to have heard of PrEP and to have used PrEP in the past year, although coverage was low. They were also more likely to be HIV-positive, to be better educated, transgender, and to not report recently having a female sex partner. It is likely that NGOs target and attract HIV-positive MSM because of their provision of MSM-friendly HIV testing and follow-on support for accessing HIV care. This possibly accounts for why NGO clients were more likely to be HIV-positive than non-NGO clients.

Evidence suggested that although coverage of NGOs remained stable over time, the percentage of HIV-positive MSM registered in AIDS centres and on ART increased over time, as did the percentage of MSM ever tested for HIV. Conversely, the overall levels of condom use remained stable, while HIV prevalence also remained stable over time, among both all MSM and those aged < 25 years, suggesting that HIV incidence has not decreased over this time period.

Comparison with other literature

To our knowledge, no other studies from Ukraine have looked at associations between NGO intervention contact among MSM and how that affects risk behaviours, the HIV cascade of care and uptake of condoms. We have looked at a similar issue among people who inject drugs in Ukraine and found similarly consistent beneficial associations of contact with NGOs [20]. Overall, there has been limited research on the HIV epidemic among MSM in Ukraine. Another study using IBBS data reported, in agreement with our study, that contact with NGOs was associated with reductions in unprotected anal intercourse among MSM [21]. Similar to our findings, other studies of multiple IBBS rounds have found stable HIV prevalence over time among MSM [22,23]. Another study of MSM in Kiev found a HIV prevalence of 24.1% in 2014 [24]; this was higher than the prevalence we found among MSM in Kiev (10.8%), possibly due to a misclassification of low-risk MSM as heterosexuals, leading to an elevated prevalence among those captured, which has been reported in other studies [25].

Globally, few studies have considered the impact of national-scale HIV programmes for MSM on individual-level HIV prevention and treatment outcomes. One large-scale study utilizing a national IBBS of MSM ($n \sim 10\,000$) in India found that increased numbers of integrated counselling and testing centres in an area led to higher levels of awareness of HIV status [26], while contact with these centres increased HIV testing [27]. Other earlier studies in southern India (also utilizing large-scale surveys) showed that the Avahan HIV prevention intervention for MSM (and female sex workers) increased condom use in MSM, averted considerable infections and was cost-effective [28]. Otherwise, much smaller subnational studies among MSM ($n \sim 500\text{--}1000$) have shown that contact with drop-in centres is associated with increased HIV testing in Myanmar [29], while scale-up of prevention activities in Senegal may have increased condom use and reduced sexually transmitted infections [30]. This illustrates how our large national-scale multi-round analysis among MSM in Ukraine is relatively unique in the HIV literature at the individual level, particularly for eastern Europe and Central Asia.

Strengths and limitations

Our analyses' main strengths include using multiple national-level IBBS that have large sample sizes, span many years and ask comparable questions over the surveys. The surveys considered diverse topics, allowing examination of varied outcomes. Our findings give a consistent picture that contact with HIV prevention NGOs is associated with beneficial outcomes. Our use of survey data across 26–28 cities in Ukraine, covering all regions, means that the results should be generalizable to the national level. However, around 90% of the participants of these surveys were aged < 40 years, which is probably younger than the age profile of MSM at a national level, which should more closely match that of the general population where around 45% of adult males are aged < 40. Regarding education, a similar percentage of males in the survey had higher education (33%) as in the general population aged 15–40 (28%) [31].

As the study is observational, we were limited to looking at associations rather than causation. It is possible that those in contact with NGOs are also more likely to have more positive health-seeking behaviours than non-NGO clients. Although most questions were the same or similar across years, some changed or were unavailable for particular years. This did not generally affect our analyses. Also, while most major cities/regions were sampled in all IBBSs, some (3/28) were omitted for certain

rounds. HIV viral load was only tested among a subsample of HIV-positive MSM in later surveys to help estimate incidence and therefore could not be used as a biological marker of successful ART uptake; self-reported ART uptake measures can be problematic [32]. Assessing trends over a limited number of time points can sometimes cause difficulties with interpretation if some estimates appear to be outliers. This was the case for estimates of ART coverage in 2015, which differ from other years. The reasons for this are uncertain but could be due to chance because of the small number of MSM testing or self-reporting as HIV-positive used as the denominator. Further rounds should help clarify trends.

While the results for HIV infection were based on biological testing, all other data on behaviours and interventions were self-reported and could therefore be affected by varying levels of bias. This is a common weakness in these types of analysis based on bio-behavioural survey data. Recall bias could be an issue due to the surveys asking questions about behaviours over several months, while participants could also answer questions in ways they deem desirable to those asking the questions (social desirability bias), which could lead to a systematic underestimation of harmful practices. It is unclear whether this would affect NGO and non-NGO clients differentially; however, there is a possibility that, as some of the surveys were carried out in the offices of NGOs, clients would report outcomes that NGOs (the harm reduction providers) would want to hear – an information bias.

Implications and conclusions

Ukraine's HIV epidemic is the second largest in Europe [4], with MSM making up a sizeable portion of the country's epidemic [5]. Our findings show that contact with NGOs within Ukraine is associated with beneficial outcomes for MSM through receipt of more condoms, increased HIV testing and improved linkage to HIV treatment, thus suggesting a positive impact of harm reduction programming, although these analyses cannot prove causation. To halt the HIV epidemic in Ukraine, as recommended by UNAIDS' ambitious elimination targets [33], it is paramount that MSM are put on ART while condom use is maximized for reducing transmission. From October 2020, the US Centres for Disease Control will support NGOs to start providing ART. This follows a 2018 report by Deloitte suggesting that NGOs should have an expanded role in providing HIV care [34]. However, current data suggest that HIV prevalence and incidence are not decreasing among MSM in Ukraine, indicating that more effort is needed to improve current levels of HIV

treatment and condom use. Our analyses suggest that this could be achieved through scaling up the coverage of MSM NGOs, which currently only reach about a third of MSM according to our study. Unfortunately, this could be a difficult task because Ukraine is currently experiencing a decrease in Global Fund monetary support [13], has only recently emerged from economic recession, is still engaged in a war with Russia [14,35], and is likely to experience a further economic downturn due to the ongoing COVID-19 pandemic [36]. Despite these issues, it is crucial that Ukrainian policy-makers ensure funding for MSM interventions is not reduced, but rather increased, to have greater public health benefits [37] as achieved in other MSM HIV epidemics [38,39]. As in these settings, consideration should also be made to introducing PrEP, which could have a dramatic effect on reducing HIV acquisition [7]; a pilot intervention in Kyiv has shown the feasibility of such an intervention [40].

Acknowledgements

We would like to thank all the people who participated in the surveys used in this paper and those who collected the data, including the Global Fund to Fight AIDS, Tuberculosis and Malaria and the US Centers for Disease Control (CDC), which funded the surveys.

Conflict of interest: NS, TS, YS and OV work for the Alliance for Public Health (APH), Ukraine, which is a non-governmental organization. The Global Fund to Fight AIDS, Tuberculosis and Malaria (GF) or other international funders had no role in these analyses or in decisions to publish. APH is one of the largest recipients in Ukraine of funding from the GF, and the salaries of YS and TS are funded through GF grants. JS reports non-financial support from Gilead Sciences, outside the submitted work. JGW reports previous grants from the CDC Foundation and a current research grant from Gilead unrelated to this work. PV has received unrestricted research grants from Gilead unrelated to this work.

Financial disclosure: This work was supported by the APH, Ukraine, via the Global Fund to Fight AIDS, Tuberculosis and Malaria. PV is supported by the UK National Institute for Health Research (NIHR), Health Protection Research Unit (HPRU) in Evaluation of Interventions at the University of Bristol. PV and AGL also acknowledge funding from NIAID and NIDA (R01AI147490 and R01DA033679), with JS also acknowledging support from NIDA (R01DA033679). The 2009–2013 IBBSs were funded by the Global Fund to Fight AIDS, Tuberculosis and Malaria and those from 2015–2017 by the CDC.

Author contributions

All authors contributed to the study and/or manuscript writing and provided their approval to submit. PV had the original idea for the manuscript. AT performed the analyses and drafted the manuscript with guidance from AGL, JGW, J, and PV. NS, TS, YS and OV assisted with the interpretation of results.

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Supporting Information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

Table S1 Behaviours and preventive outcomes among men who have sex with men across each survey year, with respondent-driven sampling weights.

Table S2 Unadjusted and adjusted odds ratios (with 95% confidence intervals) from mixed-effect logistic regression* for various intervention-related outcomes from being an NGO client *vs.* not being an NGO client – the adjusted results correspond to Fig. 1.

Table S3 Adjusted odds ratios (with 95% confidence intervals) from mixed-effect logistic regression for education categories on various intervention-related outcomes (corresponding to Table S2).